Information Needs for Adaptation to & Mitigation of Climate Variability & Change

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Outline

I. Introduction

II. What is climate variability?

III. What can we do about it?

* Information

* Policy

IV. Recommendation

Background

- **Climate** refers to the statistical averages of weather elements prevailing over a given place during a long period of time whereas

- **Weather** is the instantaneous state of the atmosphere and it is what we experience from day-to-day.

- **Climate variability** is a fluctuation of climatic parameters from the normal or base line values whereas

- **Climate change** is a change in the long term means value of a particular climatic parameter. It is a persistent long-term change.

Background

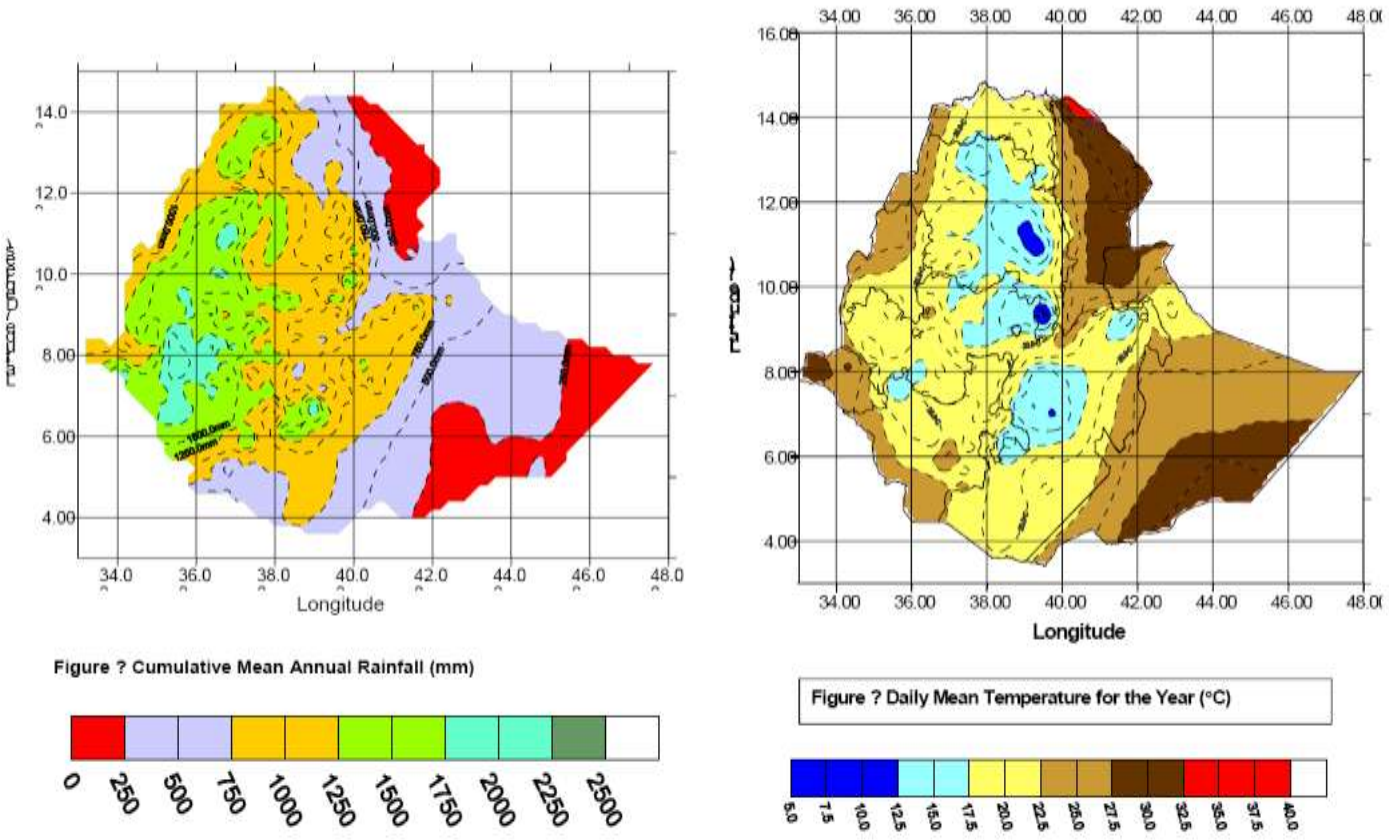


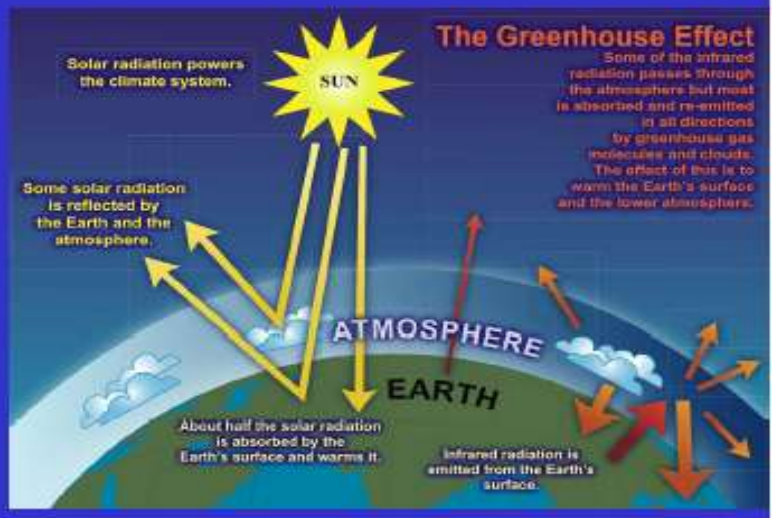
Figure 2.1 : Mean Annual Rainfall and Temperature Distribution over Ethiopia (source NMA, 2001).

Background

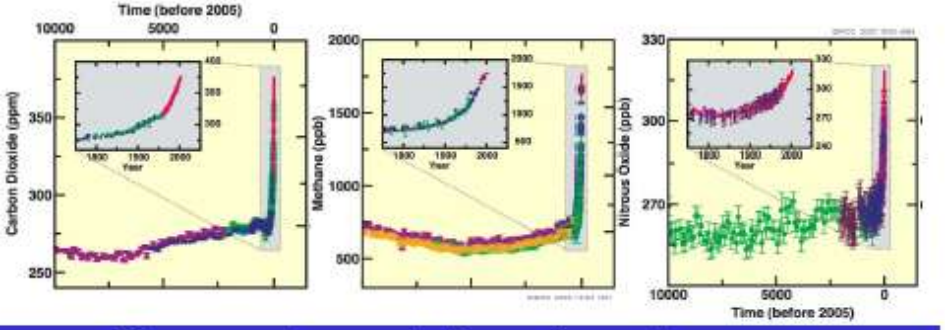
The greenhouse effect

The natural greenhouse effect increases surface temperatures by about 30°C.

Increasing greenhouse gas concentrations tends to increase surface temperatures.



Industrial revolution and the atmosphere

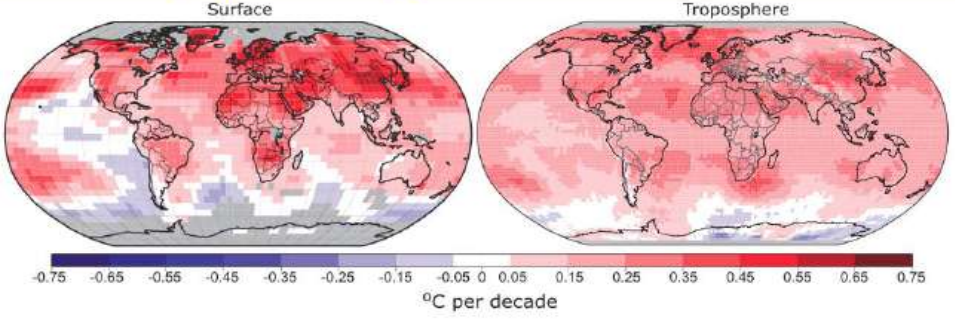


The current concentrations of greenhouse gases and their rates of change are unprecedented.

Warming is truly global

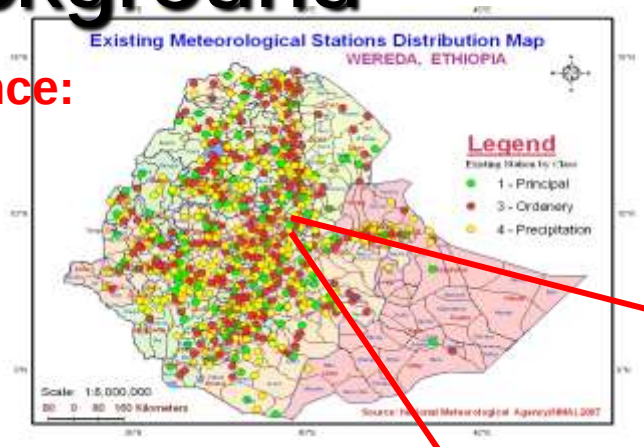
Warming trends since 1979 (when satellite measurements started) show:

- Warming everywhere at surface except in eastern Pacific, Southern Ocean and parts of Antarctica;
- Land warming significantly faster than ocean over last 20 years;
- Mid-troposphere warming consistent with that at surface.

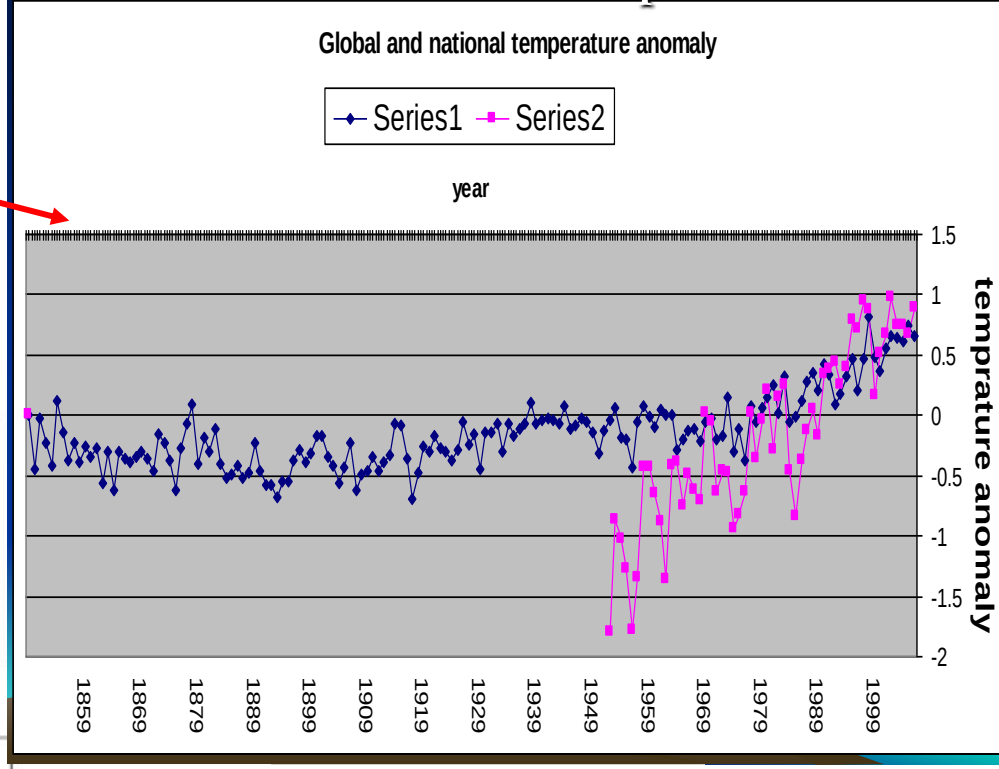


Background

Evidence:



Global and national temperature trends



Climate variability and trends

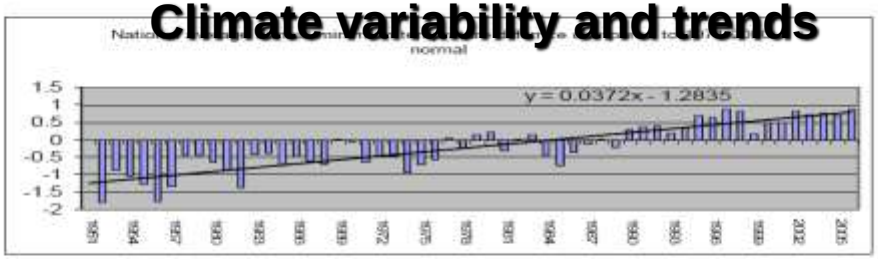


Figure 1: Year to Year Variability of Annual minimum Temperature over Ethiopia expressed in temperature.

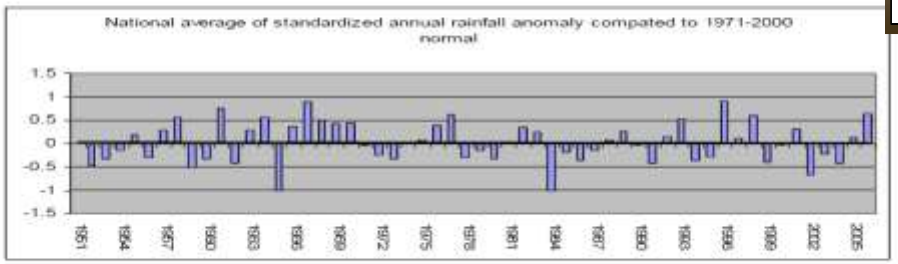
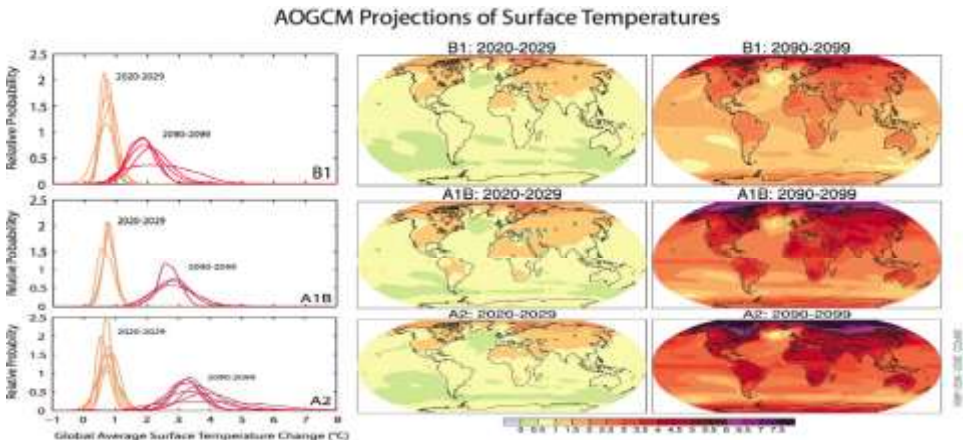


Figure 2: Year to Year Variability of Annual Rainfall and trend over Ethiopia expressed in Normalized Deviation.

Background

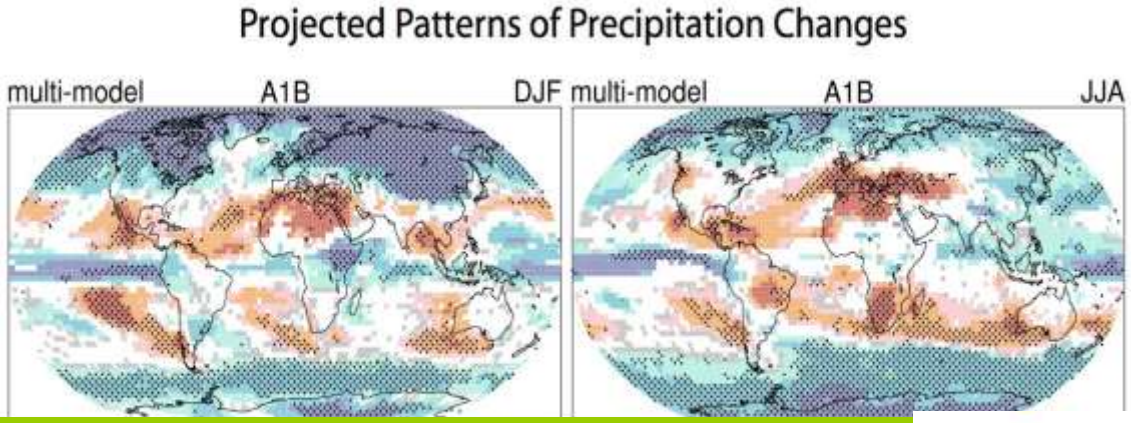
IPCC 2007



Projection of future global climate change (temperature)

IPCC 2007

Projection of future global climate change (precipitation)



Climate projections for Ethiopia:

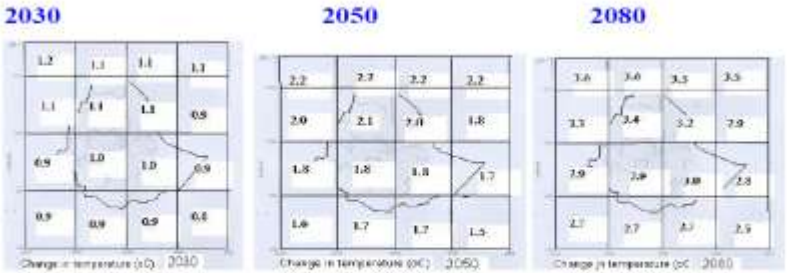


Figure 3: Composite (average of 19 GCMs) change in temperature (°C) relative to 1961-1990 normal for A1B emission scenario.

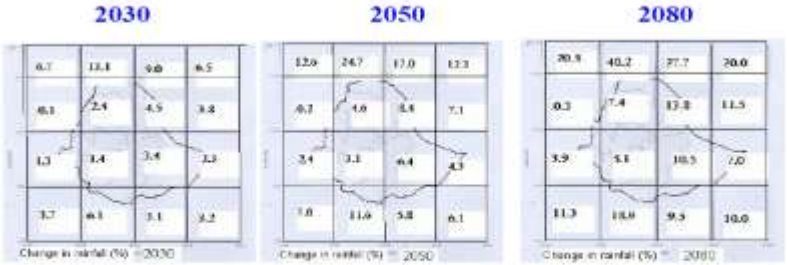
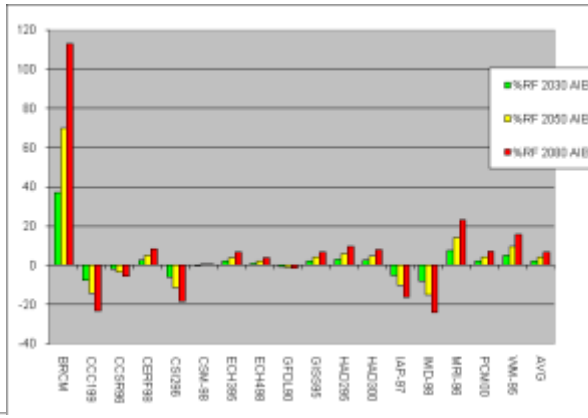
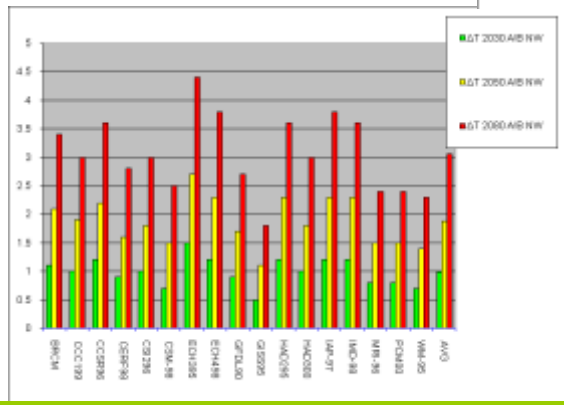


Figure 4: Composite (average of 19 GCMs) percentage change (%) in rainfall relative to 1961-1990 normal for A1B emission scenario.

Inter-model range in temperature projections for northwest Ethiopia:



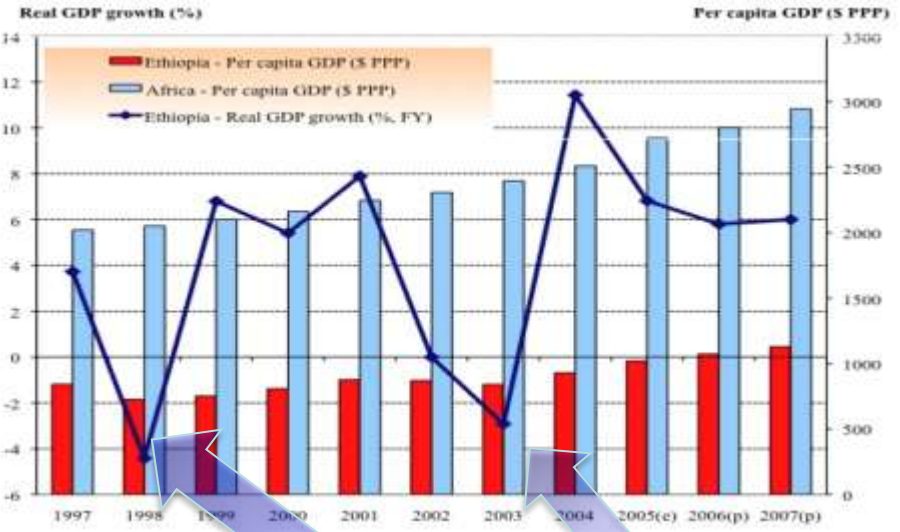


Importance of climate

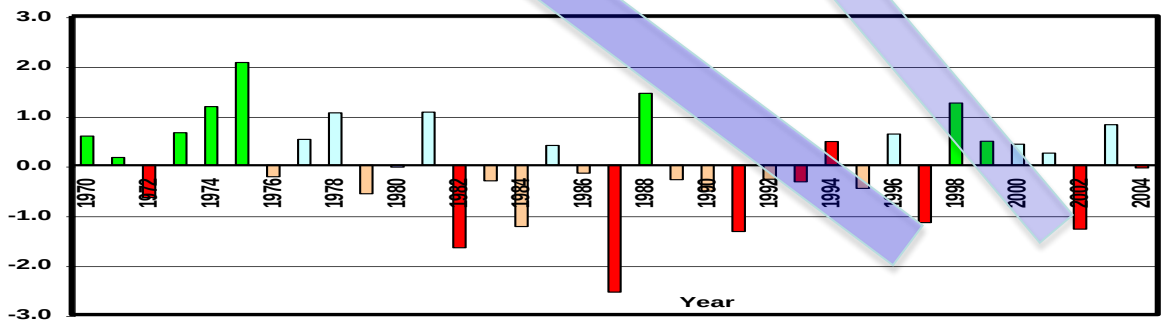
- Climate affects almost all wakes of life but some are more sensitive than others
    - Agriculture (food security)
    - Water supply
    - Health
    - Energy supply
- Climate information is vital for decision making and planning

Potential impacts of climate change

- Shorter length of growing period (days to maturity) and a decrease in crop yield
- Water availability (decrease/increase in runoff)
- Human health (horizon of Malaria areas expanding)
- Change in ecosystems
- Impact on Development:



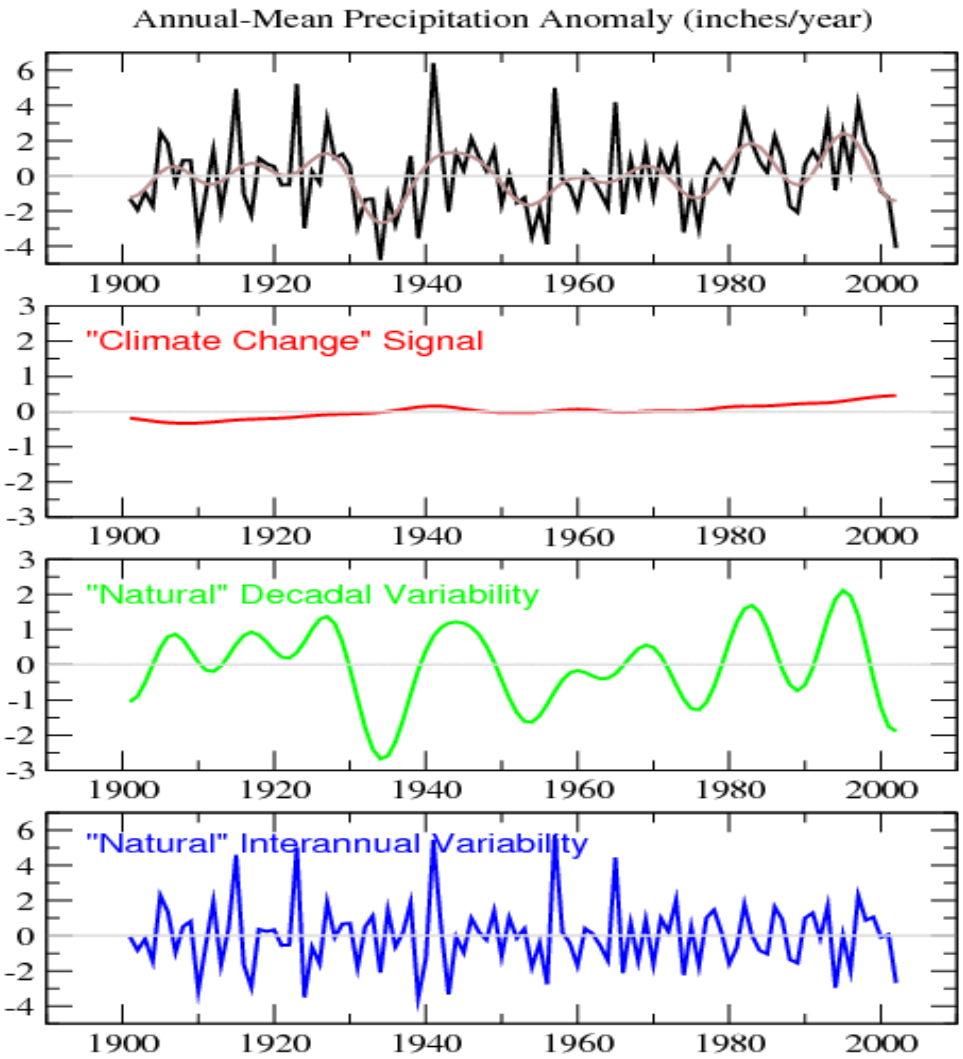
Ethiopia: Real GDP growth and Per Capita GDP (Sources OECD, 2006)



Korecha and Barnston(2007)

What is climate variability?

Fluctuations in the Climate at Different Time Scales



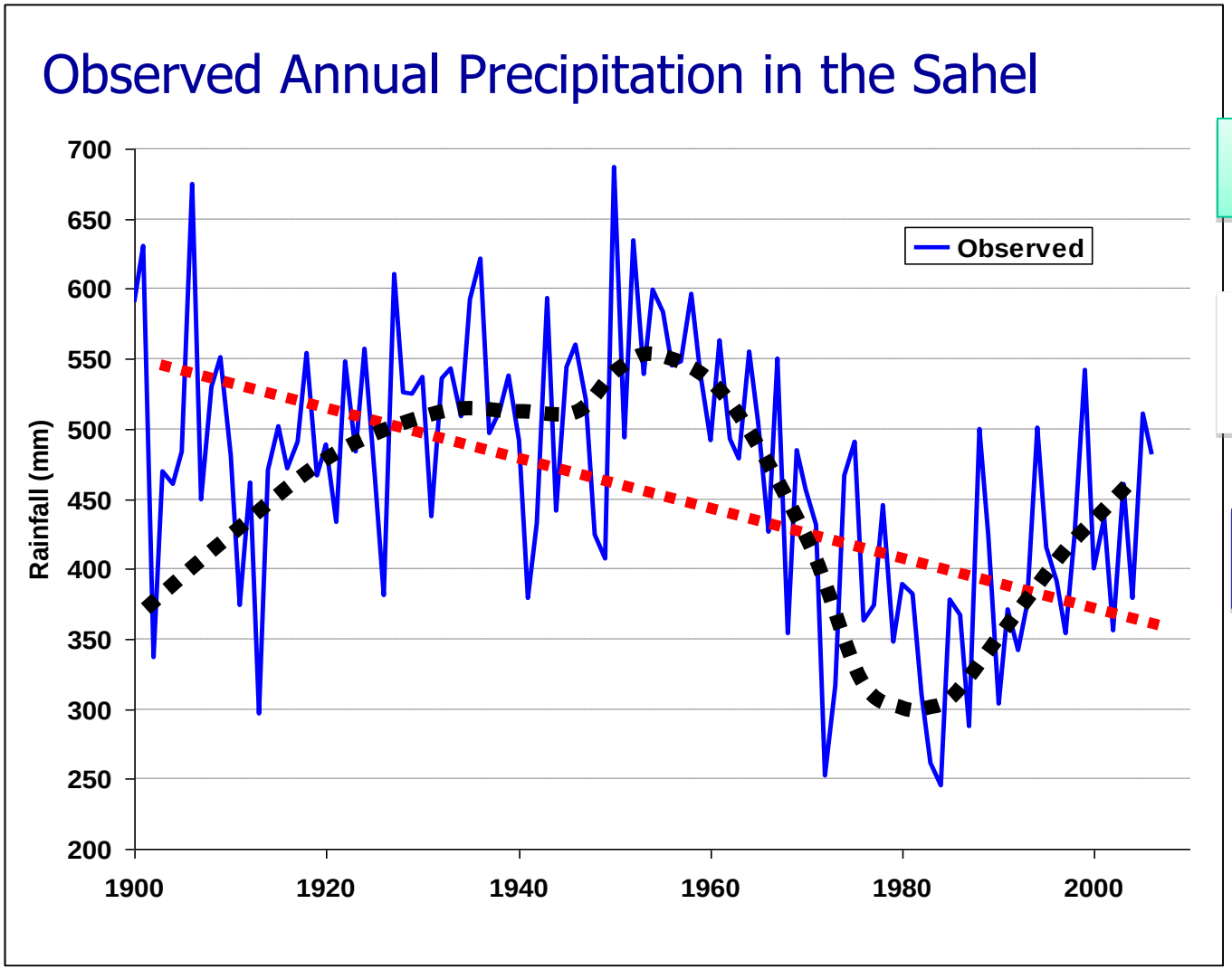
1%

25%

74%

Courtesy of
Lisa Goddard,
IRI

Timescales of Climate Flactuations



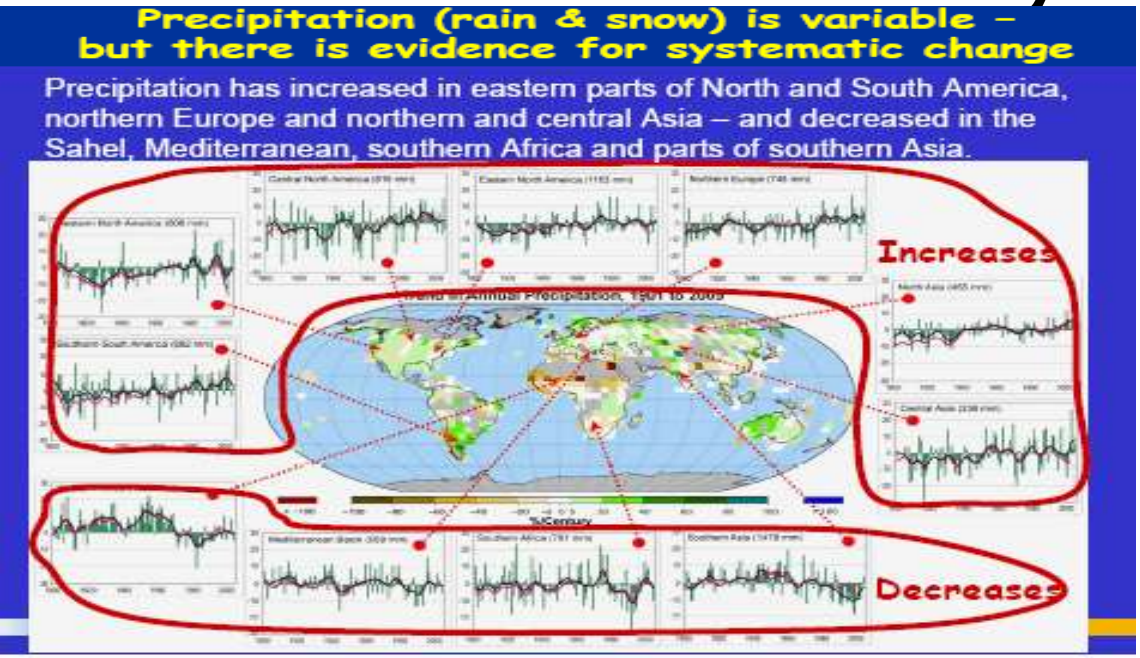
Decadal Variability
250mm in 20 years

Interannual Variability
380mm in 5 years
290mm one year to next

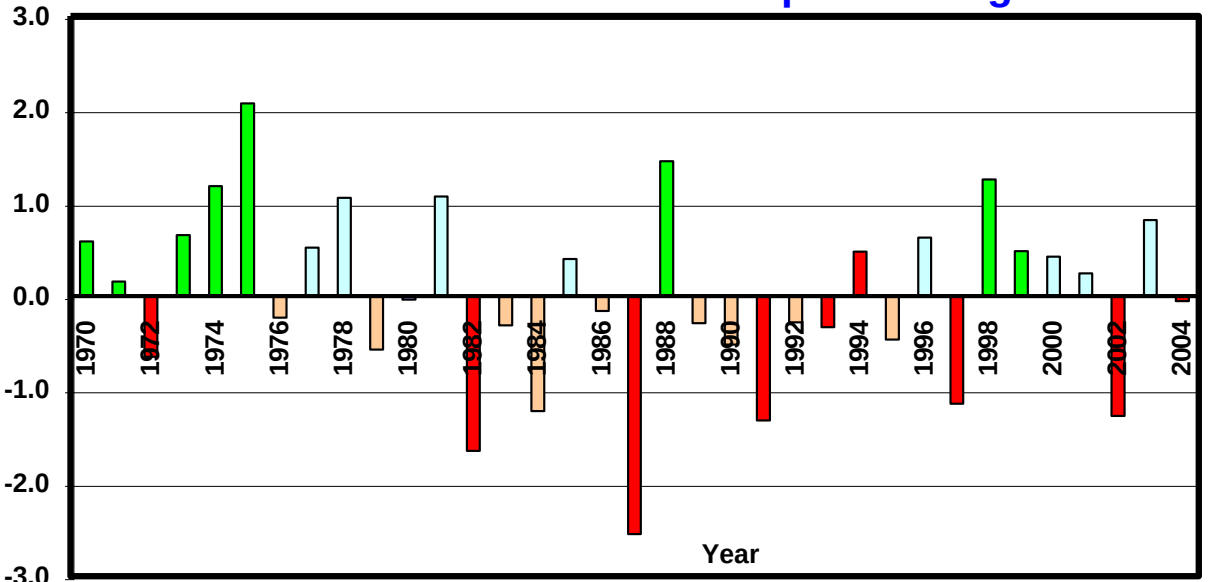
"Climate Change"
180mm in 100 years

Courtesy of
Walter Baethgen, IRI

Climate Variability over Ethiopia



Standardized summer rainfall anomalies over Ethiopian during 1970-2004



Korecha and Barnston(2007)

Link to Climate Change/Adaptation

- We are more vulnerable to climate change because we are poor

- Climate variability has contributed to our poverty

➔ Managing climate variability will help reduce vulnerability to climate change

- One aspect of climate change is expected increase in climate variability

➔ Managing climate variability will pave the way for adaptation to climate change

What can we do about it?

1. CLIMATE INFORMATION

2. POLICY

Climate Risk Management (CRM)

The use of climate information in a multidisciplinary scientific context to cope with climate's impacts on development and resource-management problems.

Approach : Four components

(from months, through Decades, to Climate Change)

Identify Vulnerabilities and Opportunities in Climate Variability and Change in Collaboration with "Users"
(which systems, what components within systems)

Reduce Uncertainties
(learn from the past, monitor the present, provide relevant info on the future)

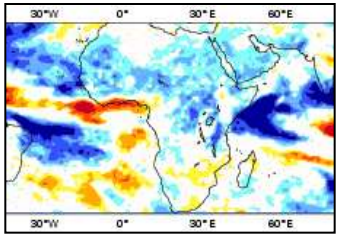
Identify Interventions (Technologies) that Reduce Vulnerability
(e.g. drought resistance cultivars, water holding capacity)

Identify Policies and Institutional Arrangements that reduce Vulnerability and/or Transfer Risks
(Early Warning Systems, Insurance, Credit)

(Baethgen. 2010)

Example: Operational crop forecasts

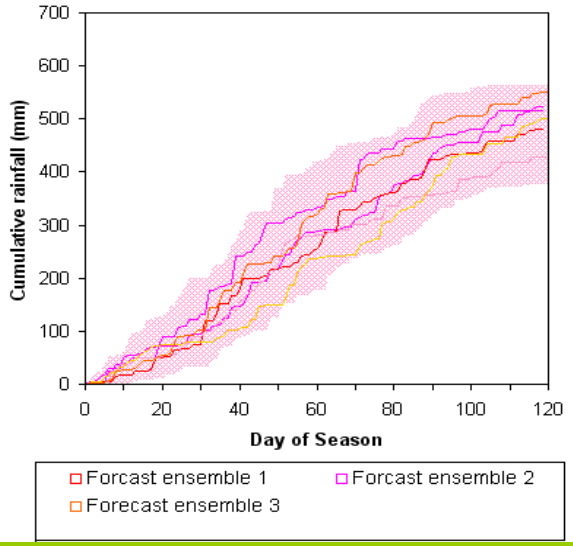
Start of season

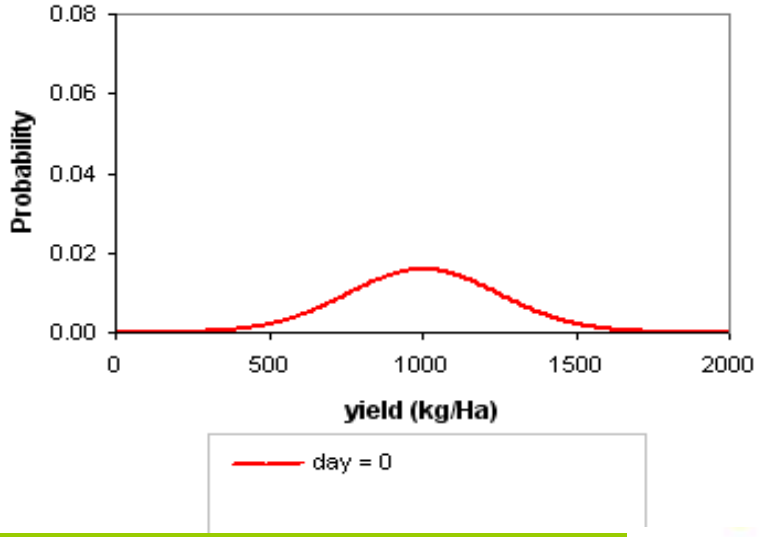


Seasonal weather forecast

Crop model

Initial histogram of crop yield





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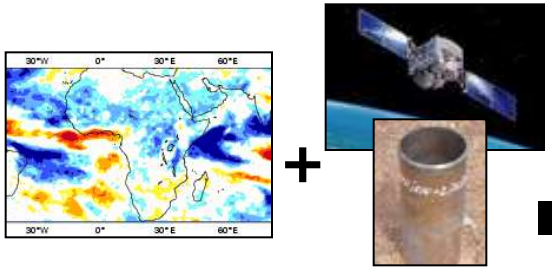
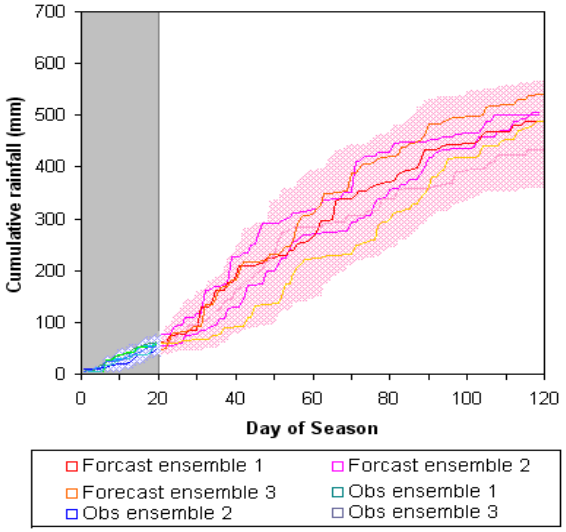


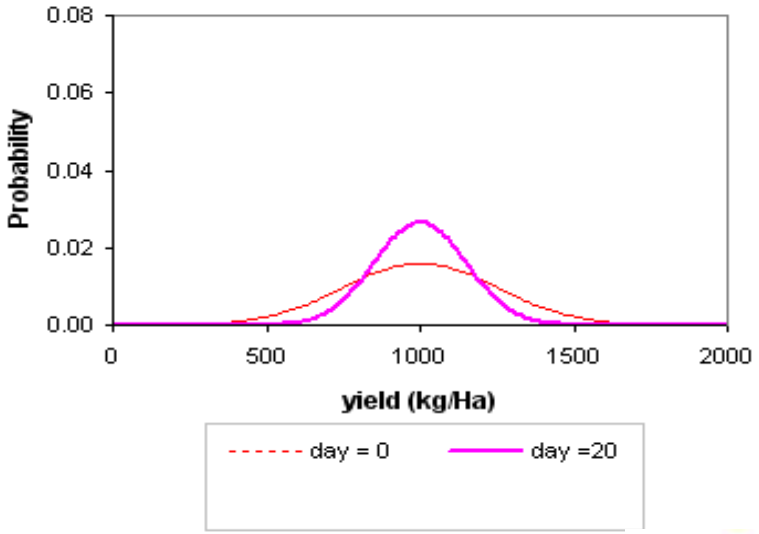
Seasonal weather forecast
updated with observations

Crop model

Mid season

Updated histogram of crop yield





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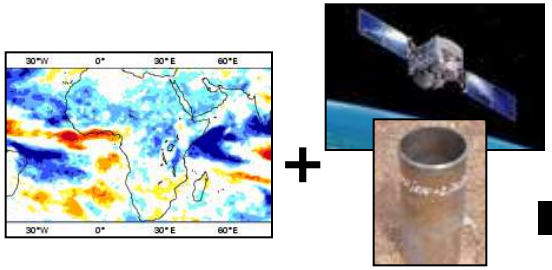

Seasonal weather forecast
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Mid season

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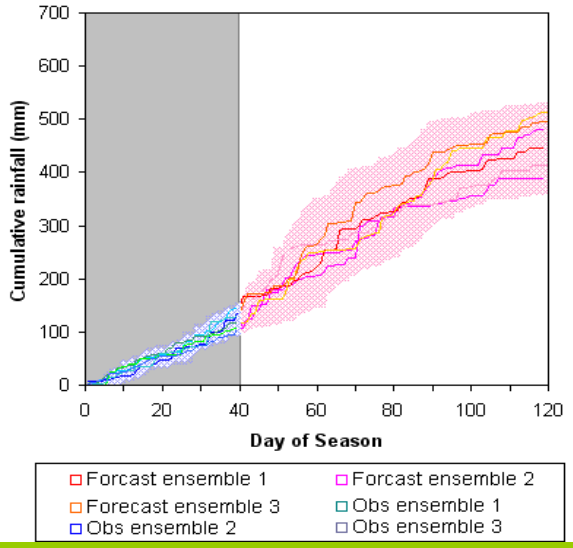

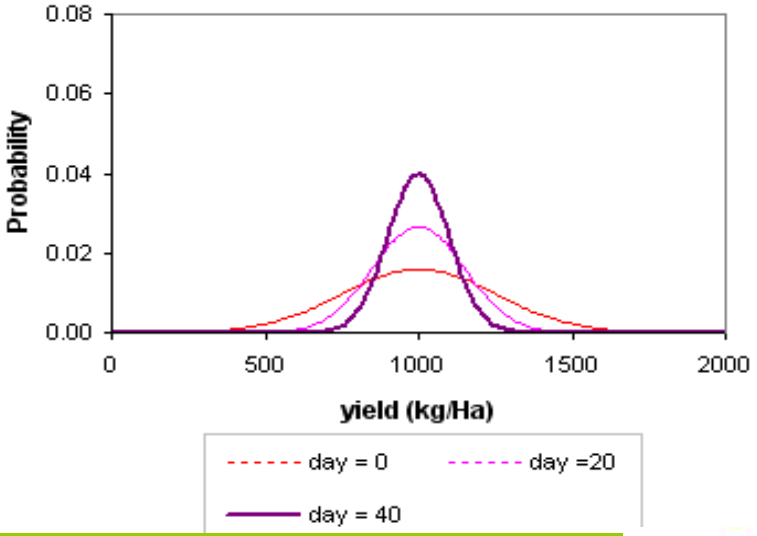

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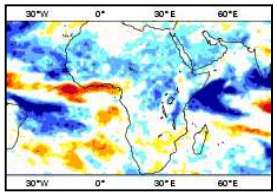

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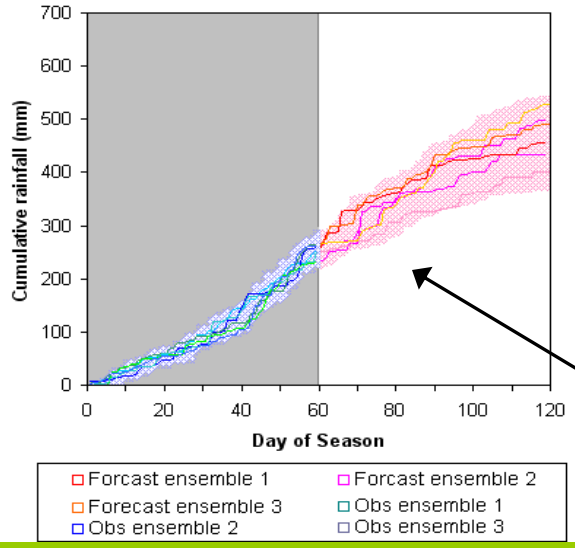
Seasonal weather forecast updated with observations

Crop model

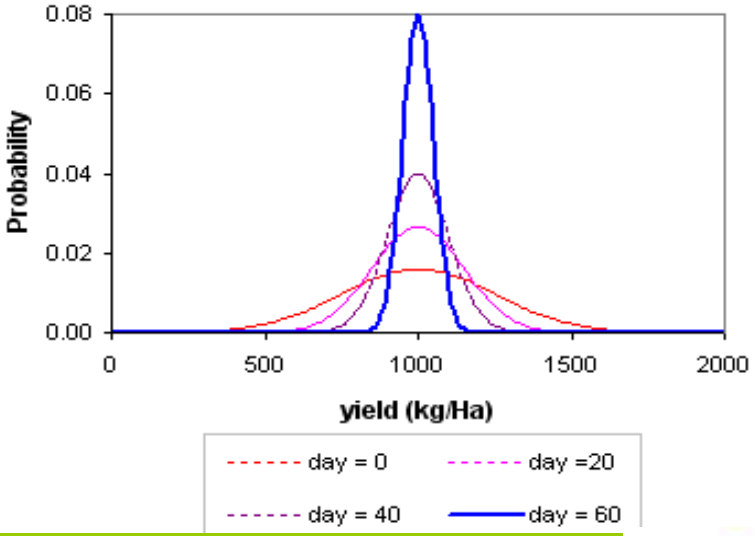
Mid season

Updated histogram of crop yield

(courtesy: Helen Greatrex, UoR)



Updated seasonal forecast



What about data?

(CRM involves the use of climate information)

Three Type of Climate

1. Historical data

- **Inform on mean climate, trends, climate statistics (extreme events etc)**
- **Basis for planning and optimizing investments**
  - ☛ **Not easily available/accessible in many parts of Africa**

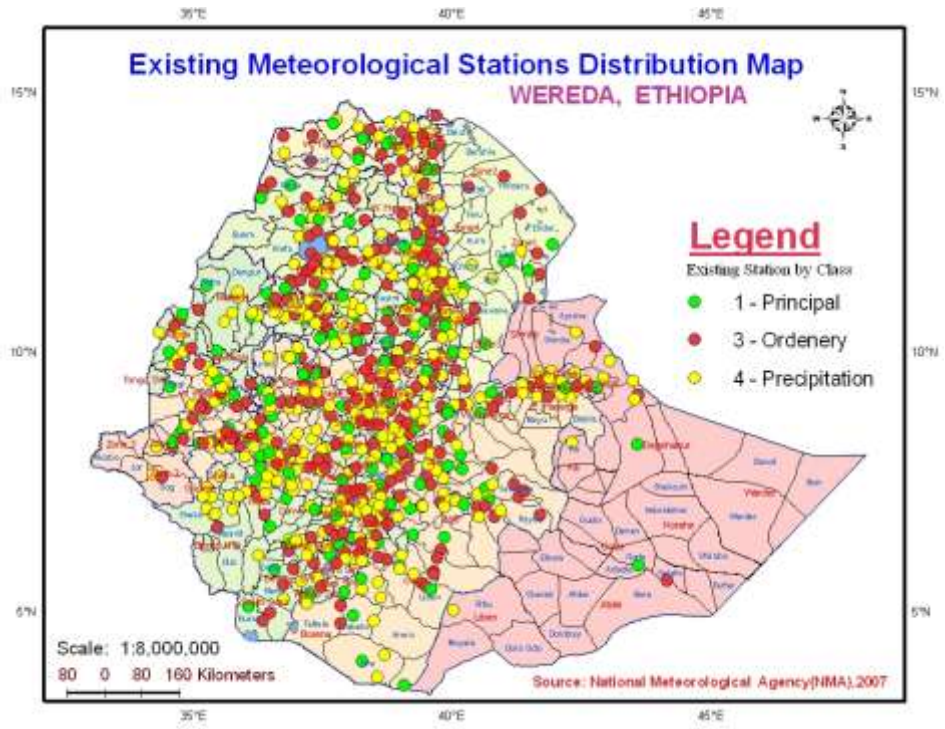
2. Real time data

- **Current observations, short term forecasts (weather)**
- **Monitoring of floods, droughts, disease…**

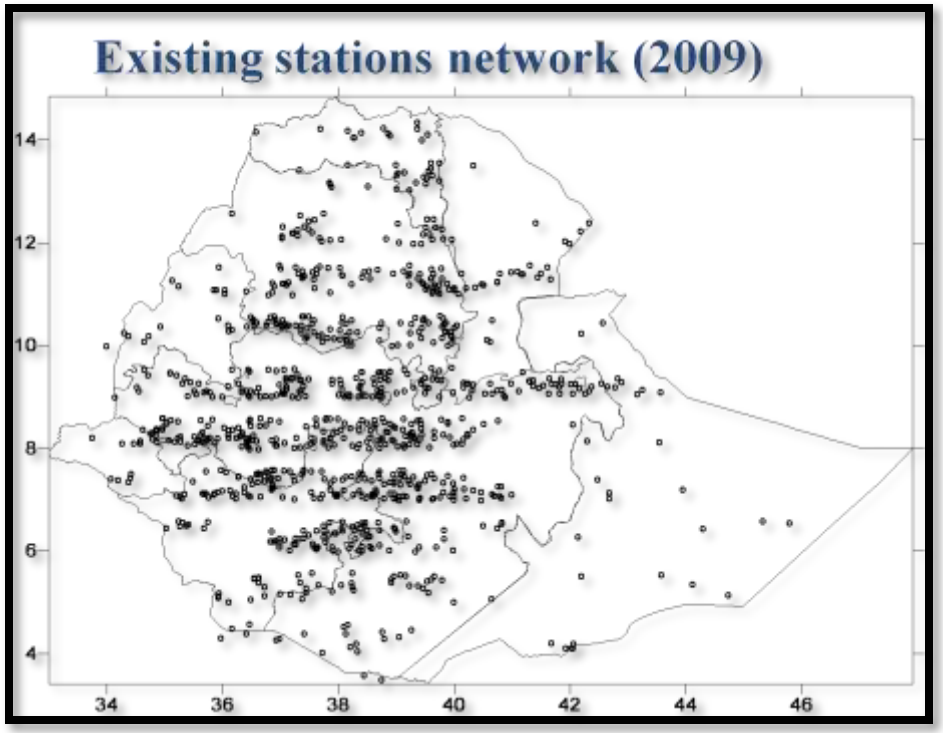
3. Climate/Weather Prediction/ forecasts

- **Weather (medium range), season, climate change…**
- **To help operational risk management, contingency planning**
  - ☛ **Including the uncertainties attached to forecasts into decision-making process is a challenge**

Data situation in Ethiopia



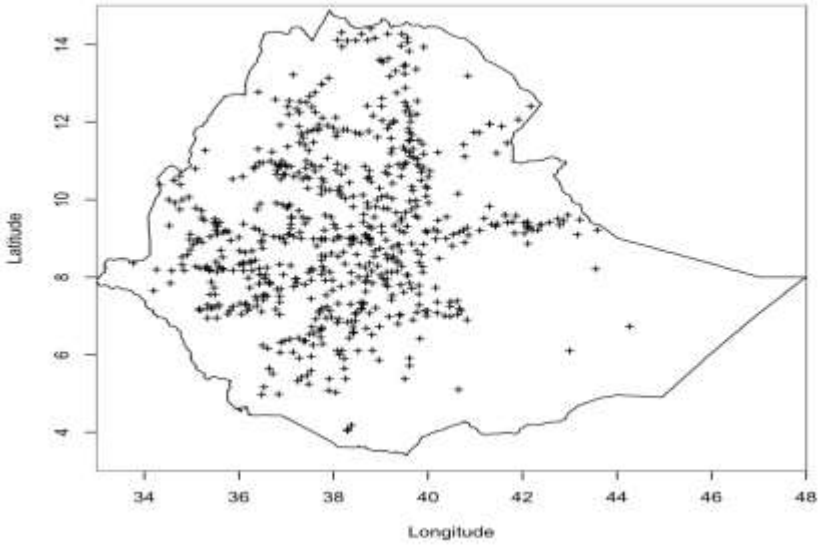
Station Type	No.
Synoptic/GTS	17
Class I	160
Class III	471
Class IV/Rainfall	419
Total	1067



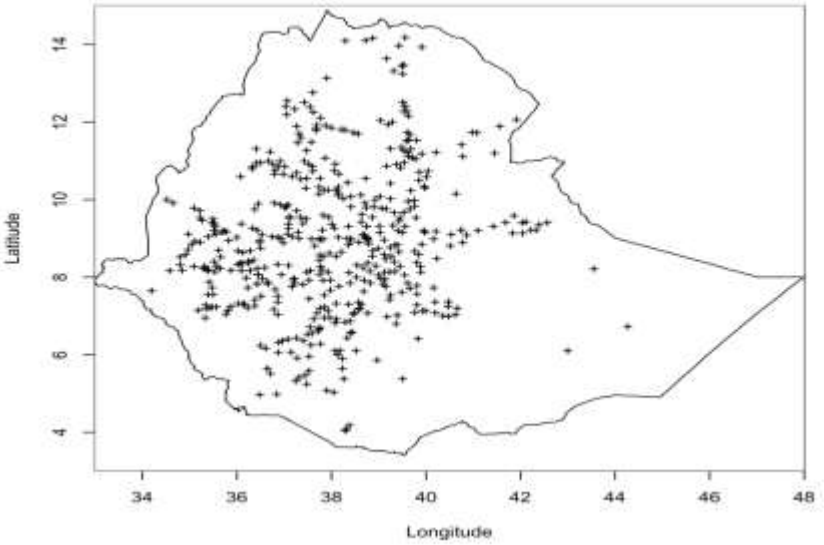
- About 1100 conventional surface stations
- 35 Automatic Weather Stations
- 50 - 110 years of data
- About 150 SSB radio based station for near real time data collection
- 11 Regional Branch Offices
- More than 887 permanent employees

Station distribution with rainfall data(1981-2008)

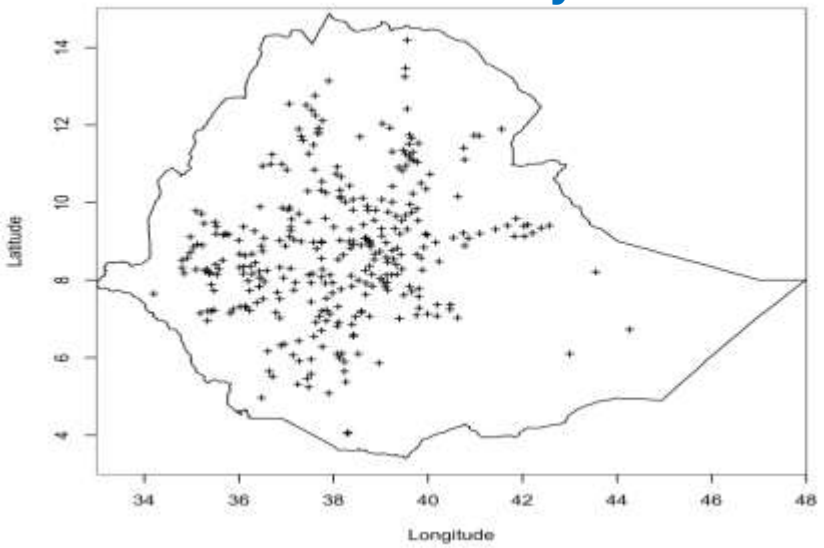
All rainfall stations



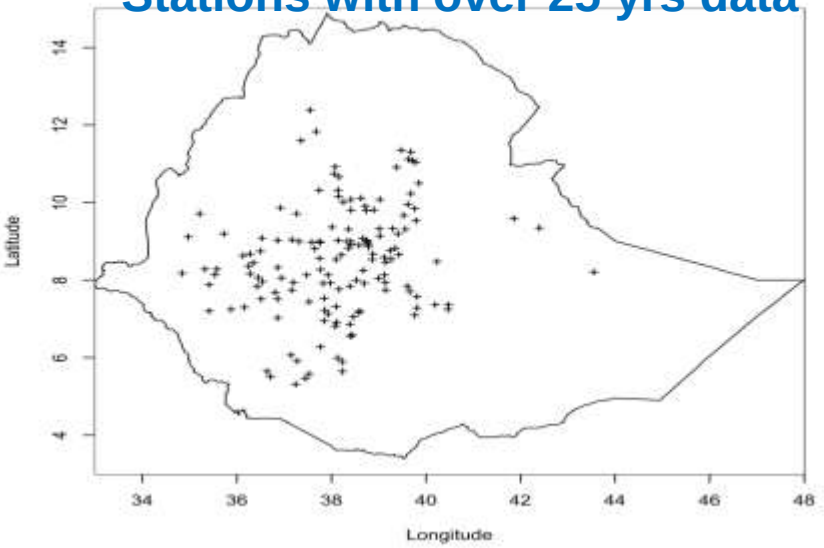
Station with over 15 yrs data



Station with over 20 yrs data

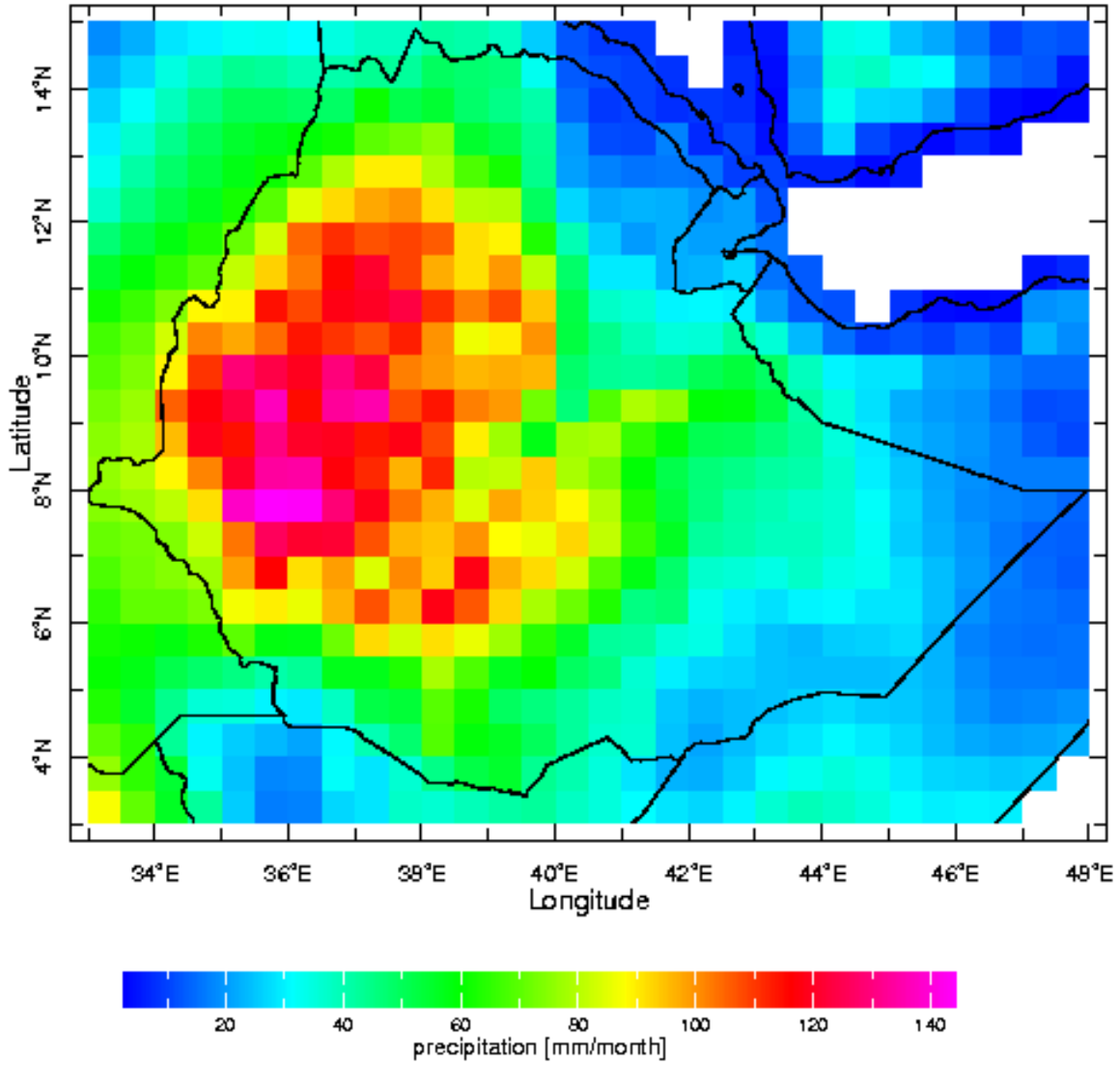


Stations with over 25 yrs data



To overcome data gaps …

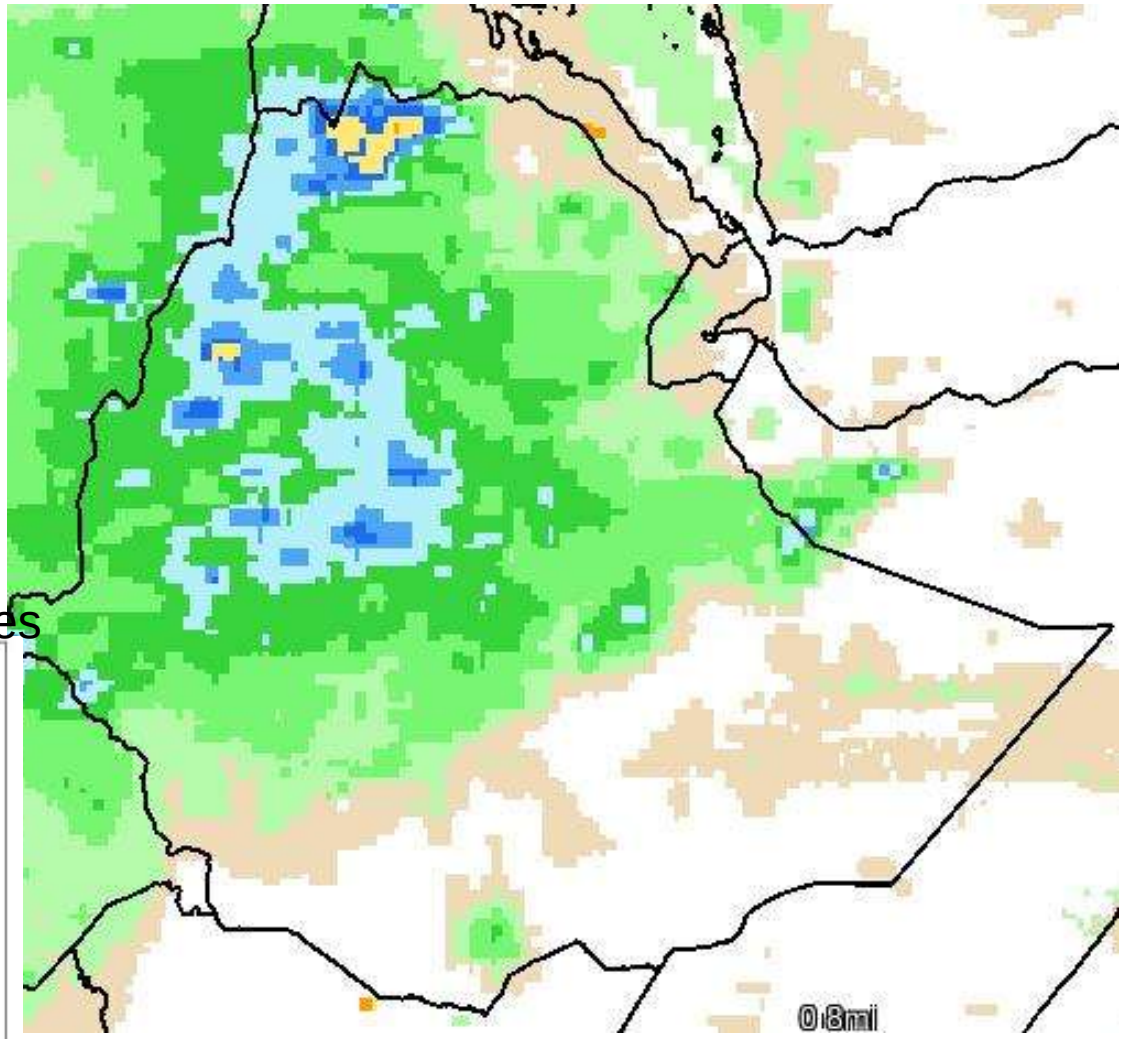
Gridded data could help, but its quality is limited by station



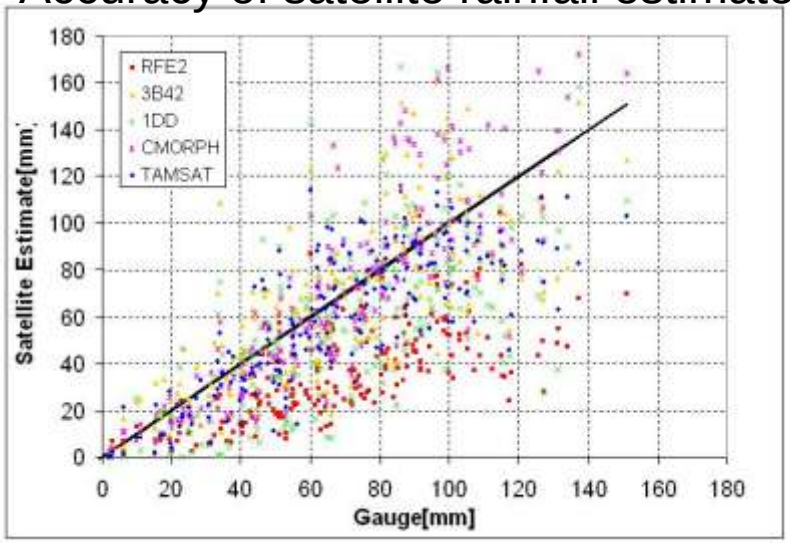
To overcome data gaps …

Satellite data have **excellent** spatial converge

But …

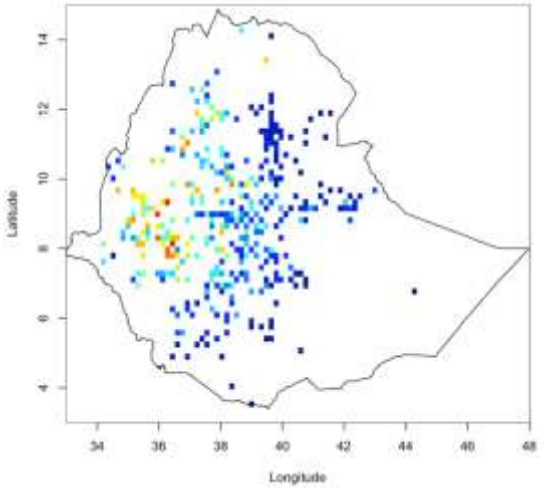


Accuracy of satellite rainfall estimates



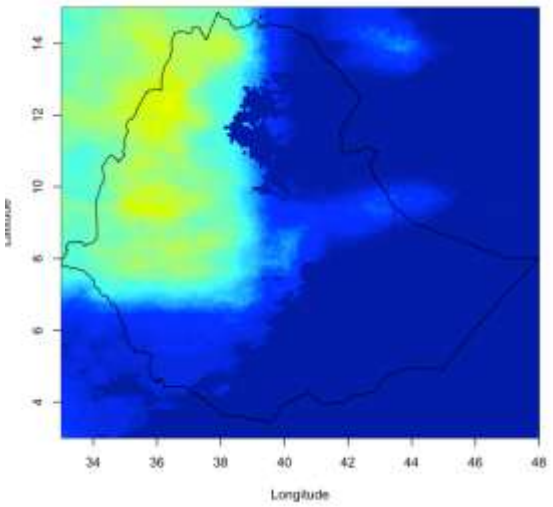
The Google project (IRI-NMA Project) Outputs

The Concept of blending satellite data with station data



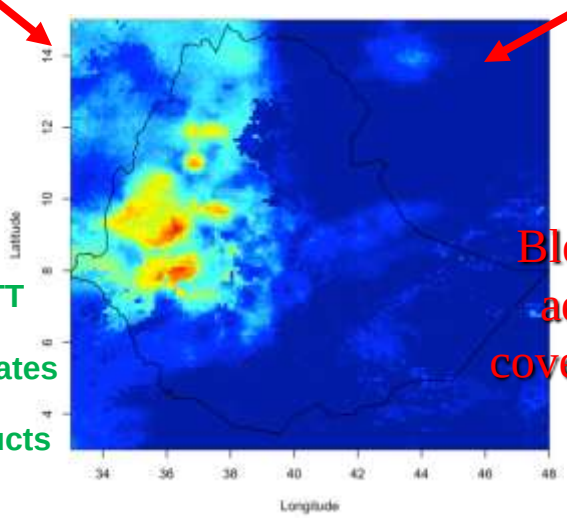
Conventional stn data

Less spatial coverage



Satellite data

Smooth out peak rain



Blended

Output:

Ten-daily time series at 10 km resolution:

- **Thirty-year time series of Gridded RR/TTT**
- **Thirty-year time series of Satellite estimates**
- **Thirty-year time series of Blended products**

Blending the two products will take advantage of the excellent spatial coverage of satellite data and the point accuracy of the rain gauge measurements

INFORMATION GAPS

Gap in data availability and accessibility

- Gap in data spatial coverage
  - Data spatial coverage are not sufficiently representative
- Gap in data temporal coverage
  - Data coverage are not temporally homogeneous
- Gap in data quality
  - Data are full of gaps and error
- Gap in data accessibility
  - Historical data not digitized (except rainfall and temperature)
  - Data delay (both for real time monitoring and research)
- Climate projections are a not at a higher resolution

•Lack of research on climate data (e.g., how best we can use the available data)

2. POLICY

Policy and Institutional Framework

- The Ethiopian Government has already put in place a number of policies, strategies and programmes aimed at enhancing the adaptive capacity and reducing the vulnerability of the country to climate variability and change. Such programmes include:

  - the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP),
  - the **Environmental Policy**, and
  - the **Agriculture and Rural Development Policies and Strategies**.

- The Government has established a Strategic Investment Framework for sustainable land management (SLM).
- The Environment Policies of Ethiopia (EPE) and Conservation Strategy of Ethiopia (CSE) are the **two umbrella instruments** regarding the environmental management in Ethiopia.
- Most policy recommendation contained in the EPE and CSE are very much relevant to the CC mitigation and adaptation
- The UNFCCC calls for the specific needs and special situations of LDC's to be addressed in the form of Climate Change National Adaptation Programmes of Action (NAPA), identifying, in a participatory process, who is vulnerable and to what.

Policy and Institutional Framework

- Central to the NAPA process is the **integration** of climate change adaptation activities with national development policies to ensure effective implementation of adaptation activities.

- The NAPA process in Ethiopia identified arid, semi-arid and dry sub-humid areas of the country as being most vulnerable to drought; **agriculture** was identified as the most vulnerable sector; and in terms of livelihoods, small-scale rain-fed subsistence farmers and pastoralists are identified as the most at risk.

- The NAPA process has identified and prioritized eleven project areas that address the immediate climate change adaptation needs in the country, focusing on human and institutional capacity building, improving natural resource management, enhancing irrigation agriculture and water harvesting, strengthening early warning systems and awareness raising.

Ethiopia's Climate-Resilient Green Economy (CRGE)

CRGE aims to position Ethiopia as the green front runner in developing climate resilient green economies

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

Ambition: Establish Ethiopia globally as the green frontrunner

- **Negotiations** - PM H.E. Meles Zenawi **global leader** of international climate change negotiations
- **Planning** – Ethiopia **creates transparency** how green growth can be achieved
- **Collaboration** – Ethiopia **enables neighboring countries** to achieve green development by providing cheap clean electricity
- **Invention** – Ethiopia **paves the way for green global** livestock sector by developing RELS – Reduced Emissions from LiveStock

…allowing

- Job/ value creation and poverty reduction
- Carbon funds to finance economic development
- Increased food security
- Increased exports and reduced imports
- Improved health (air and water quality)
- Improved balance of payments
- Preserved biodiversity

Source: EPA

Ethiopia's Climate-Resilient Green Economy

Green economy strategy

To adapt to the adverse effects of climate change and develop the economy in a sustainable way, Ethiopia has initiated the Climate Resilient Green Economy (CRGE) initiative.

CRGE identified initiatives for which at least 2 of the following 3 criteria are met:

1) Initiatives supporting **economic development** of Ethiopia with the target of reaching middle income status by 2025

2) Low-carbon initiatives to grow in a resource efficient way and keep Ethiopia's **net emissions at zero at the end of 2030**. Here, investing in low-carbon infrastructure, technologies and processes will make Ethiopia a global model for new economic growth

3) Initiatives geared at increasing Ethiopia's **resilience to climate change**: These initiatives reduce Ethiopia's vulnerability to climate change related problems such as drought or flooding.

✓ Over the coming months, the Climate Resilience strategy development will be completed specifying the need for adaptation to climate change as well as proposing adaptation initiatives.

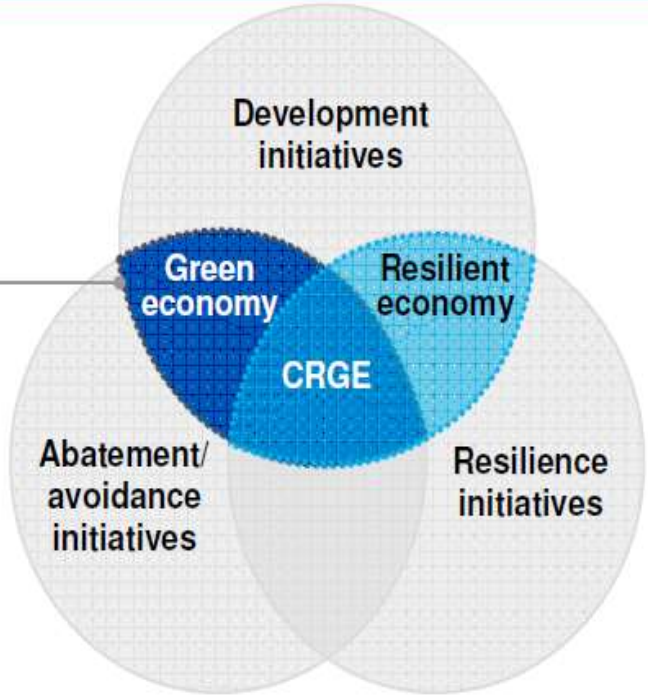
✓ Ethiopia's Climate Resilient Green Economy Strategy combines all three fields to achieve economic growth in an environmentally sustainable way.

THE DEVELOPMENT OF A GREEN ECONOMY WILL BE BASED ON FOUR PILLARS

Developing a green economy requires the integration of economic development and GHG abatement/avoidance

Combining economic growth with low GHG emissions, e.g.

- Sustainable land use via efficient agriculture
- Sequestration in forests
- Expansion of renewable energy
- Resource efficient advanced technologies



Green economy can help to avoid lock-in in old technologies, unsustainable growth and land use

The plan: To follow a green growth path that fosters development and sustainability

• The Climate-Resilient Green Economy (CRGE) initiative follows a sectoral approach and has so far identified and prioritized more than 60 initiatives, which could help the country achieve its development goals while limiting 2030 GHG emissions to around today's 150 Mt CO2e – around 250 Mt CO2e less than estimated under a conventional development path.

The green economy plan is based on four pillars:

1. **Improving crop and livestock production practices for higher food security and farmer income while reducing emissions**

2. Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks

3. Expanding electricity generation from renewable sources of energy for domestic and regional markets

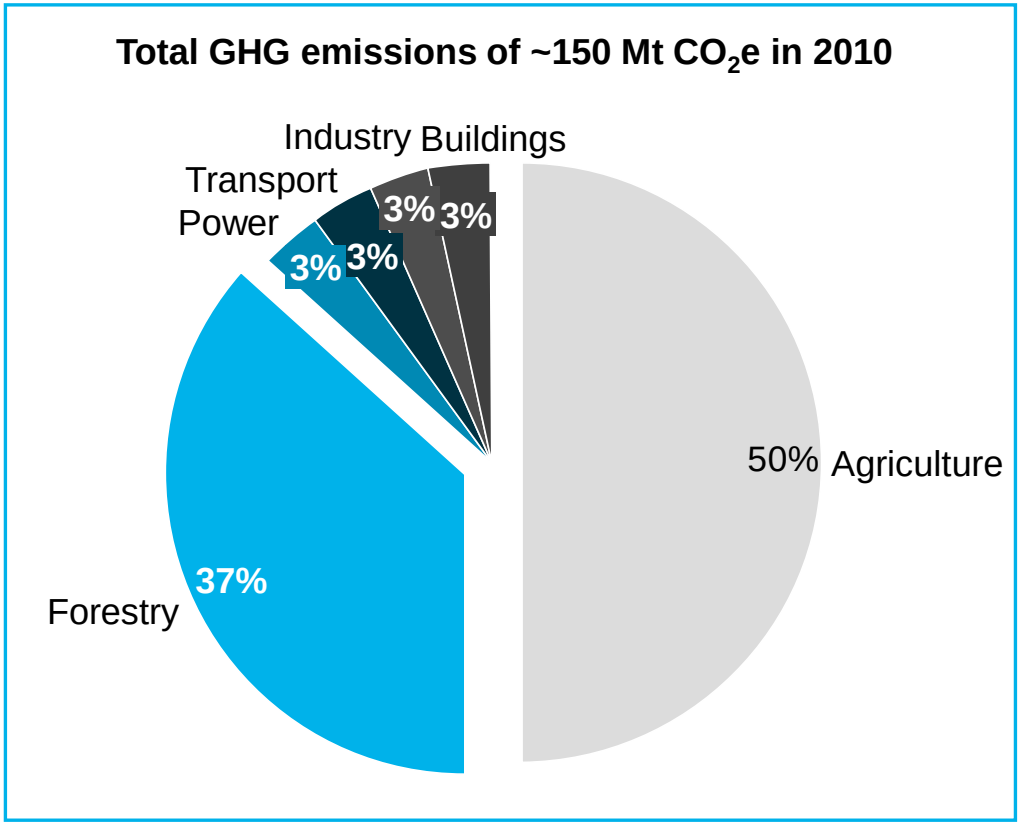
4. Leapfrogging to modern and energy-efficient technologies in transport, industrial sectors, and buildings.

Of the 150 Mt CO2e in 2010, more than 85% of GHG emissions came from the **agricultural and forestry sectors**. They are followed by power, transport, industry and buildings, which contributed 3% each.

More than 85% of today's GHG emissions in Ethiopia come from forestry and agriculture

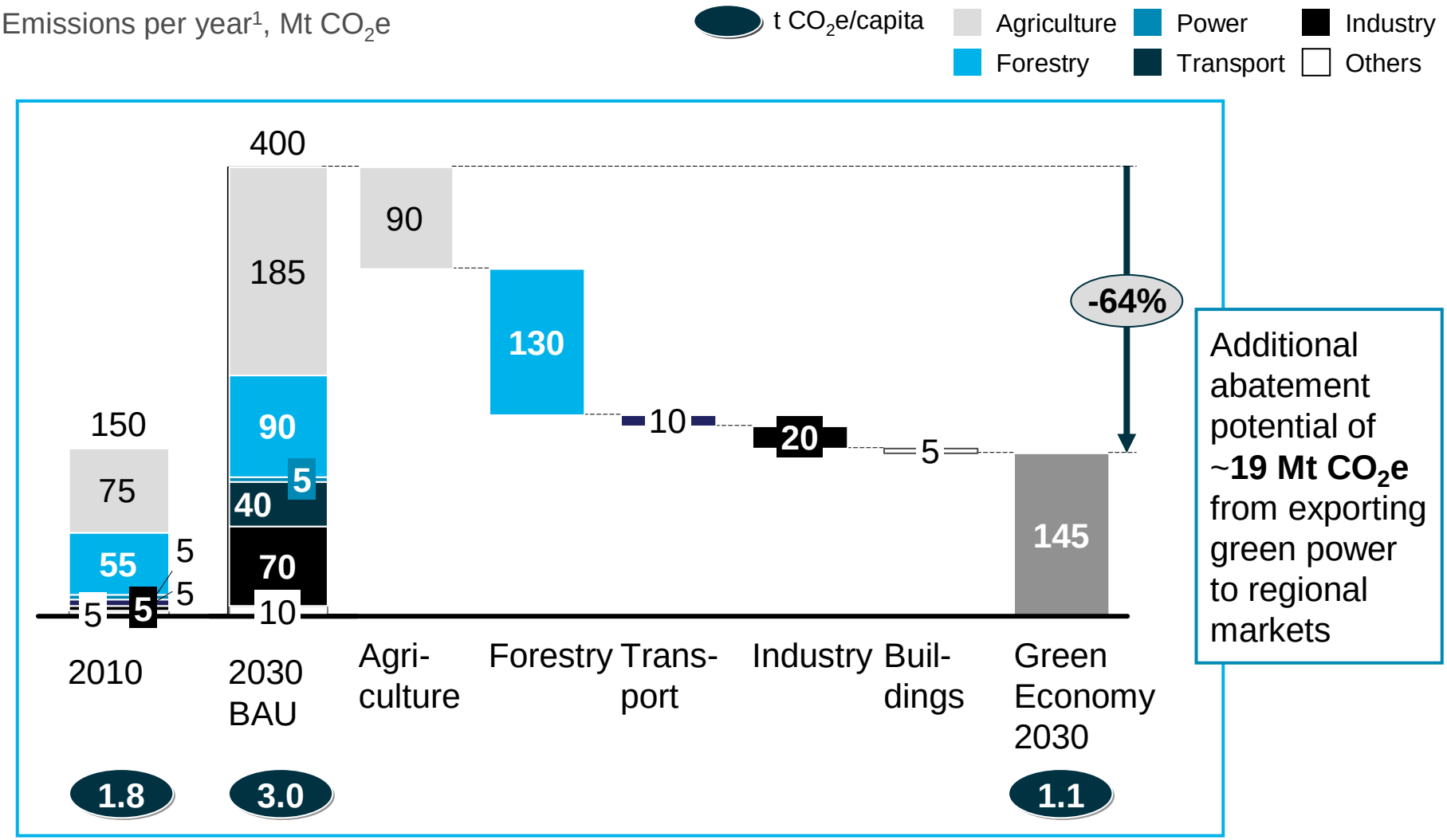
FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

Share of GHG emissions, 2010



CRGE implementation could ensure a low-carbon economic development pathway, decreasing per capita emissions by 60%

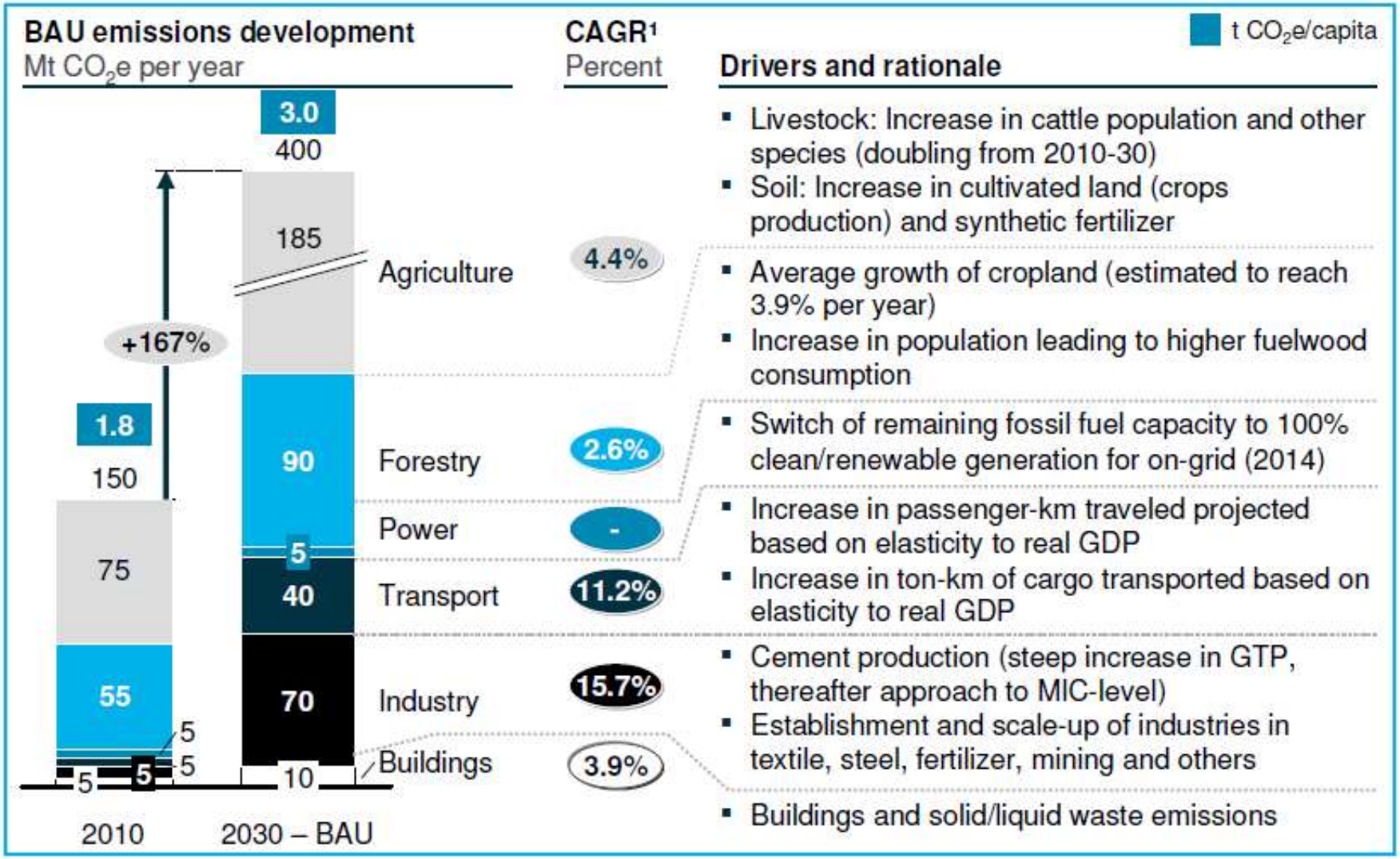
Emissions per year[1], Mt CO_2e



Additional abatement potential of **~19 Mt CO_2e** from exporting green power to regional markets

1 Rounded numbers
2 Currently estimated emissions form buildings and waste

If a typical development path were followed, emissions would increase from 150 Mt to 400 Mt (2010 to 2030)



Approach of the CRGE and the contribution of the agro forestry

•The CRGE approaches green growth by making interventions in 7 different sectors. Three of those fall underneath the Ministry of Agriculture including the **forestry, soil and livestock sector**.

• Together, the green growth initiatives in this sector account for about **220 Mt CO2e of the total 255** Mt CO2e abatement potential in the CRGE, showing the major contribution that the Ministry of Agriculture can make to Ethiopia's green economy.

•Climate smart agriculture is approached through a number of interventions in the different sectors:

1. **Soil:**

The soil sector has three included initiatives.

- ✓ Roughly 40 Mt CO2e in abatement potential is resultant from lower emitting techniques (soil nutrient and crop management, tillage and residue management and watershed management).
- ✓ Yield intensifying techniques and irrigation will allow for avoiding deforestation and their abatement potentials add up to 38 Mt CO2e.

2. **Forestry:**

The forestry sector has many attached initiatives. In total, the abatement potential amounts to 131 Mt CO2e.

✓The biggest initiatives include afforestation and reforestation at 32 Mt CO2e and

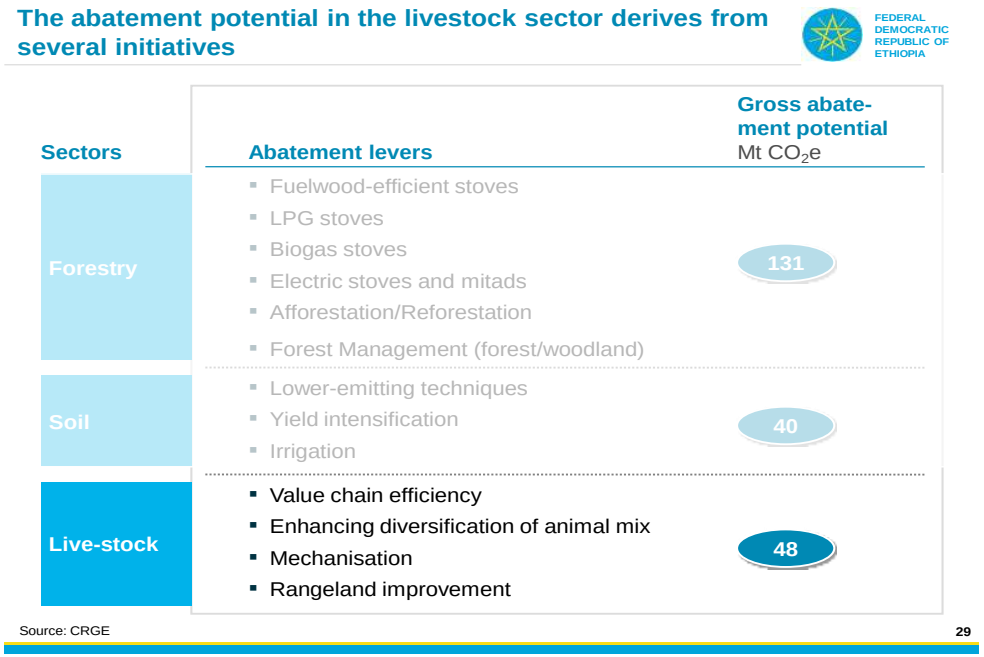
✓ fuel wood efficient stoves at 34 Mt CO2e (through avoiding deforestation as a result of fuel wood collection).

Approach of the CRGE and the contribution of the agro forestry

3. Livestock:

Thee major initiatives will stabilize herd numbers over the coming years.
These include:

✓ cattle value chain efficiency both in the highland as well as the lowland areas (16 Mt CO2e in abatement potential);
✓ increasing the share of poultry consumption from the current 15% to 30% of the national meat consumption (18 Mt CO2e in abatement potential), and
✓large scale and small scale mechanization (11 Mt CO2e in abatement potential).



• Hence, addressing policy gaps will make the sector to effectively deliver the lions share of the CRGE expectation.

CHALLENGES and POLICY GAPS to enhance the role of forests:

- **Neglected sector and weak forestry institutions**

- **Forest institutions have traditionally been more oriented towards policing and revenue collection than toward providing support to rural communities and to the private sector to engage in forestry.**

- **The sectors prioritized (e.g. water, energy, food security, health) (Policy_gap.ppt) are developing strategies without adequately considering *linkages* with the forestry sector that could have increased *synergy for impact*.**
- **Forests have not been considered in most adaptation policies of developing countries to date.**
- **Science policy interface gaps:**
  - **Limitation of policy to engage scientific information;**
  - **Limitation of science in a way palatable to policy ;**
  - **Limitations to implement policies, solutions, and innovations *based on information* that has already been generated by decades of forestry, agro forestry and genetic research.**

Conclusions and Recommendation

- **Climate is a key natural resource on which the others depend**
- **Greenhouse gases are increasing In the atmosphere exponentially**
- **Climate Change is already happening and more change is yet to come**
- **Warming trend has been observed in the country over the last 50 years**
- **Climate variability and Change have adverse impacts on many socio-economic sectors**

Conclusions and Recommendation

- There is a need for climate change Adaptation and Mitigation
- In order to mainstream climate change in plans, climate information is a critical component which needs to be used
  - **Hence, the need to Improve station network coverage;**
  - **Digitize historical data (RH, SSH, Wind speed/direction, charts, etc)**
  - **Improved data quality and access to stakeholders**
  - **Collaborative works with agriculture, health, water sectors**

- Revision of organizational setup, that is, the need for establishing a national forestry and related resource institution

- Integration of the proposed forestry and related resource institution with other institutions

- Development of policy based on cross sectoral set up

Conclusions and Recommendation

- Need for formulating research/ knowledge-based policy and strategy set up

- Presenting research outputs to guide policy makers (as scientific publication may have little importance to policy-makers). Preparation of special document that directs policy-makers.

- Bridging the rift between professional and policy-makers; policy-makers should consult professionals before making decisions.

- Undertaking solution targeted researches rather than based on personal interest.

- Devising special policies to look after critically endangered resources such as water bodies (most lakes and hydropower dams) and forests (highly threatened indigenous tree species).

THANK YOU